IOS-2.1 Compare helium H-modes in different devices

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| **TG priority:** High | **Start date:** 2015 | **Status:**  On-going | **Personnel exchange:**  Yes |
| **IO priority:**   | **End date:** 2017 | **Motivation:** Plasma Operations |

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| **Device /****Association** | **Contact****Persons** | **2016 TGRequest** | **Activity (from JEX/JA spreadsheet)** |
| **2015** | **2016** | **2017** |
| JET  | G. Sips | Desirable | Not doing |  |  |
| DIII-D  | T. Luce | Essential | Considering |  |  |
| AUG  | J. Stober | Essential | Committed |   |  |
| C-Mod  | C. Kessel | Essential | Done |   |  |
| ITER  | J. Snipes |  |  |  |  |

**Purpose/Aims**

* ITER foresees first H-mode operation in helium due to the available Padd being lower than the expected PL-H to access H-mode in hydrogen even at 2.65 T. The key objective in the ITER Research Plan (IRP) for these studies in H-mode is preparation of DT H-mode scenarios and to demonstrate the required control schemes, such as ELM control, core W transport control, radiative divertor operation and access/exit to/from H-mode.
* For the H-mode demonstration in helium it is important for ITER to document the requirements to achieve high Pped Type I ELMy H-modes in helium compared to deuterium plasmas and to document medium and high Z impurity behavior in helium H-modes compared to deuterium
* Experiments in helium have been made at several devices over the past 10 years. However, the study and optimization of type-I ELMy H-modes in helium has never been proposed as a joint experiment. The activity would coordinate experiments in helium on H-mode access and H-mode performance as function of input power. This would enable a documentation of the pedestal, ELM behavior and (high-Z) impurity behavior with matched references in deuterium.
* Indications of the impact of increasing H dilution are also important, since ITER will have H NBI and if He gas fuelling is inadequate, H pellets will be needed.

**Results for 2015**

* C-Mod obtained Type I ELMs for low density/collisionality with H minority heating. At higher density/collisionality, ELMs were mixed with returns to L mode. Analysis and comparison to deuterium reference plasmas is on-going.
* AUG is planning two weeks of helium operation in Dec.

**Plans for 2016**

* Will propose new experiments with He NBI in DIII-D. Objectives will be characterization of the operational space and pedestal/ELM behavior relative to D2 plasmas. Time permitting, preliminary work on ELM suppression with non-axisymmetric coils will be carried out.
* JET does not consider a helium campaign feasible until 2021.